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FLOOD INSURANCE STUDY

ORIGINAL

TOWN OF LA CENTER, WASHINGTON
CLARK COUNTY

SEPTEMBER 29, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 530248

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East Fork Lewis River Panel 01P

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of La Center, Washington, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Town of La Center to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by other organization(s) originally for purposes other than the National Flood Insurance Program (NFIP). The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the NFIP. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the address below for consideration for revision of this study:

> Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98011

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which this federally supported study is based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR 60.3(c). In such cases, however, it shall be understood that the State (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Portland District, as reported in the Flood Insurance Study for Clark County, Washington (Reference 1).

1.3 Coordination

On February 14, 1985, Dames & Moore was instructed by FEMA to proceed with a study for the East Fork Lewis River using data from the Clark County Flood Insurance Study (Reference 1).

The final community coordination meeting was held on September 26, 1986, and was attended by representatives of FEMA, the study contractor, and the community. No significant problems were raised at that meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of La Center, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by the East Fork Lewis River was studied in detail for the entire length affecting La Center.

The areas studied by detailed methods were selected based on the extent and validity of available hydrologic and hydraulic data.

A portion of Brezee Creek was studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA.

2.2 Community Description

The Town of La Center is located in the northwestern portion of Clark County, in southwestern Washington. The town is bordered by the unincorporated areas of Clark County.

In 1980, the population of La Center was estimated at 439 (Reference 2).

The East Fork Lewis River, with headwaters in the Gifford Pinchot National Forest of Skamania County, drains 212 square miles of mountainous timberland as it flows westerly before entering Lewis River near La Center.

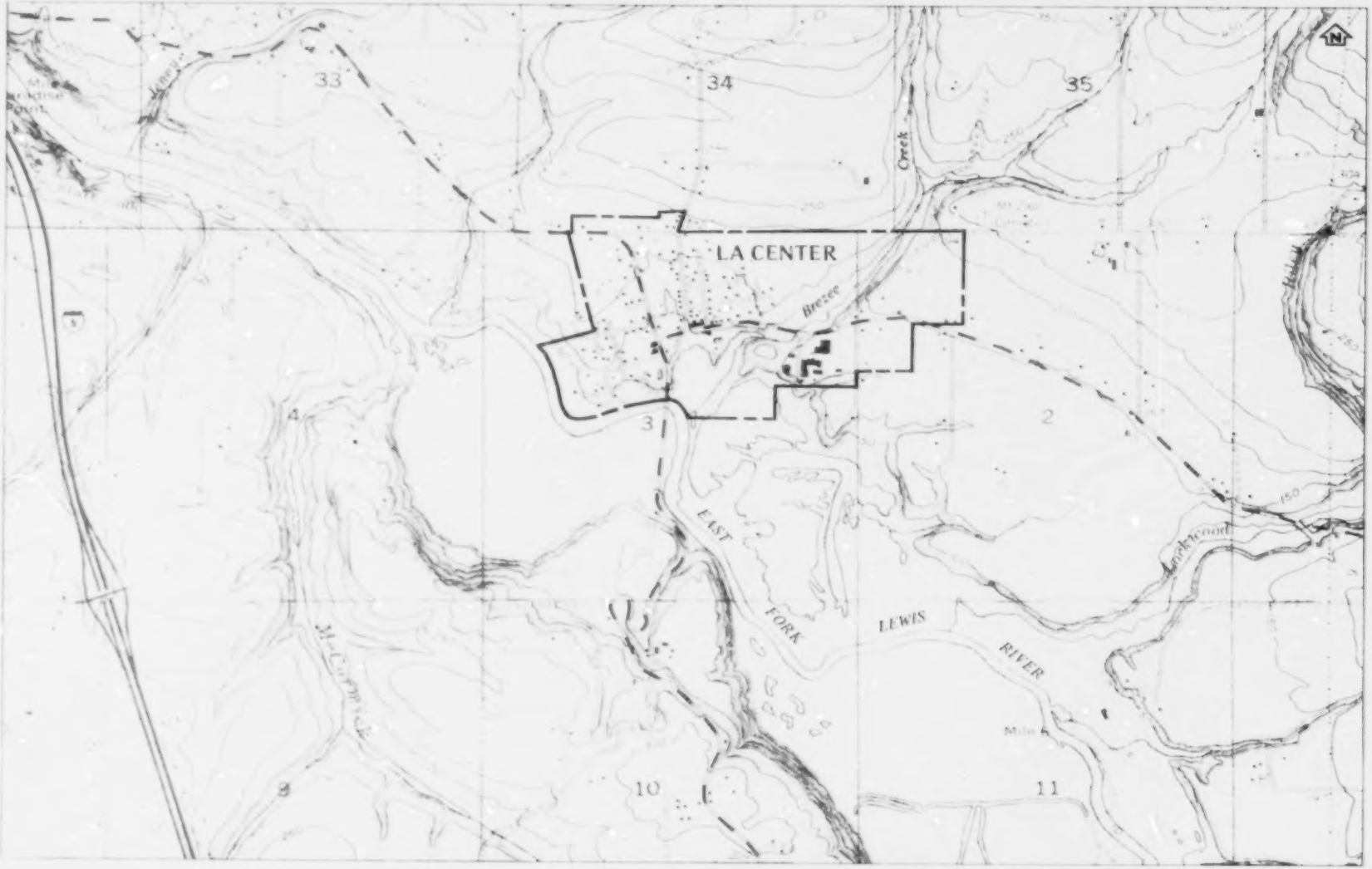


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF LA CENTER, WA
(CLARK CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

The area has a temperate marine climate typical of western Washington. Summers are dry with mild temperatures and winters are rainy with occasional snow.

More than 65 percent of the annual precipitation occurs from November through March (Reference 3).

2.3 Principal Flood Problems

A combination of intense rainfall and snowmelt caused major East Fork Lewis River floods in January 1972 and December 1977. At the gage near Heisson (River Mile 20.2), the discharge for both floods was 19,200 cfs with an approximate return interval of 100 years. These two floods caused minor damage in Clark County.

2.4 Flood Protection Measures

In south-central La Center, east of the confluence of Brezee Creek and the East Fork Lewis River, there is a levee that extends into Clark County. This structure has no effect on 100-year flooding.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The East Fork Lewis River stream gage records were statistically analyzed, using the standard log-Pearson Type III distribution, as outlined by the U.S. Water Resources Council (Reference 4).

Peak discharge-drainage area relationships for the East Fork Lewis River are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

For the East Fork Lewis River, water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 5). East Fork Lewis River starting water-surface elevations are based on Lewis River elevations at the confluence.

All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Cross sections for the backwater analysis for the East Fork Lewis River were taken from field surveys and topographic maps (Reference 6).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of stream and flood plain areas. For the East Fork Lewis River, the main channel "n" values range from 0.032 to 0.065, and for the overbank areas they range from 0.045 to 0.107.

The hydraulic analysis for this study is based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed and operate properly.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
East Fork Lewis River					
At Mouth	212	19,200	24,400	26,900	32,000
Upstream of Confluence With Lockwood Creek (River Mile 4.7)	185	17,000	21,700	23,800	28,300

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800, with a contour interval of 5 feet (Reference 6).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

Approximate 100-year flood plain boundaries in some portions of the study area were taken directly from Flood-Prone Area Maps (Reference 7).

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
East Fork Lewis River								
A	2.83	1,535/285[2]	31,767	0.8	29.8	29.8	30.3	0.5
B	3.13	700/140[2]	11,443	2.4	29.8	29.8	30.3	0.5
C	3.24	760/20[2]	11,527	2.3	29.8	29.8	30.3	0.5

[1]Miles Above Mouth [2]Width/Width Within Corporate Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF LA CENTER, WA
(CLARK CO.)

FLOODWAY DATA

EAST FORK LEWIS RIVER

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

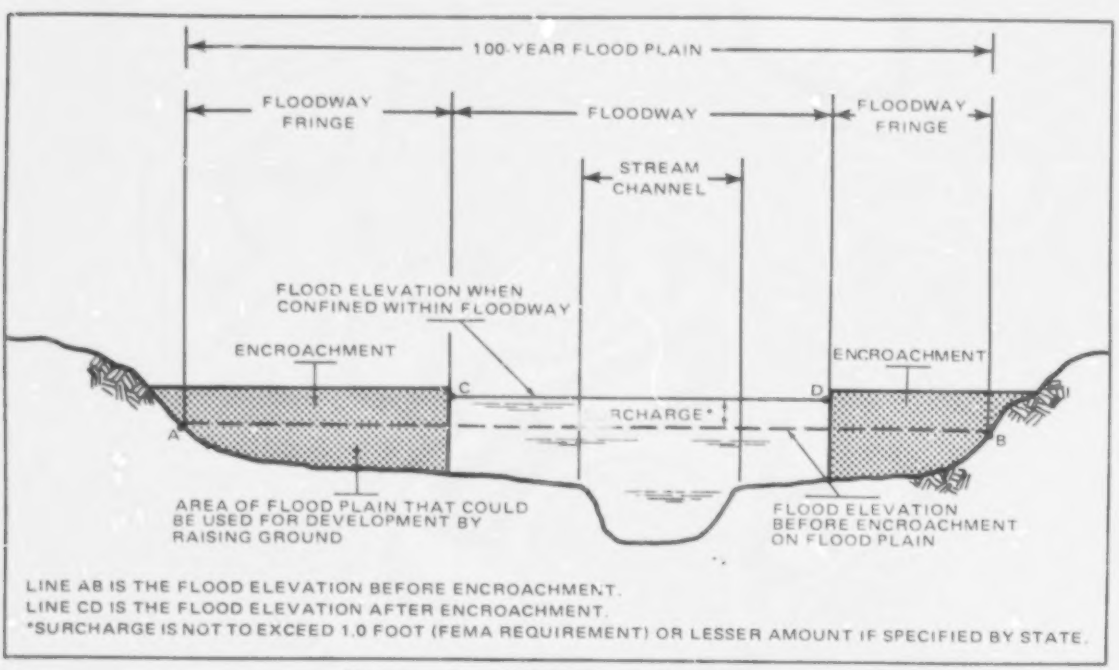

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
A
B
RCHARGE*
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the Town of La Center.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The location of the reach determined for the flooding source of La Center is shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for an FHF of 200 or greater.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
East Fork Lewis River Reach 1	0001	-6.0	-1.7	2.3	060	A12	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF LA CENTER, WA
(CLARK CO.)

FLOOD INSURANCE ZONE DATA

EAST FORK LEWIS RIVER

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone A12:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flood hazard; not subdivided.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of La Center is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

6.0 OTHER STUDIES

A Flood Insurance Study has been prepared for the unincorporated areas of Clark County (Reference 1). Information and analyses presented in this Flood Insurance Study were obtained from that report.

Because more detailed methods and updated information were used in this study, it supersedes the previously published Flood Hazard Boundary Map for the Town of La Center (Reference 8).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98021-9796.

8.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Study, Clark County, Washington (Unincorporated Areas), August 2, 1982

2. U.S. Department of Commerce, Bureau of the Census, Number of Inhabitants - Washington, 1980

3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climatological Handbook, Precipitation, Volume 2, 1969

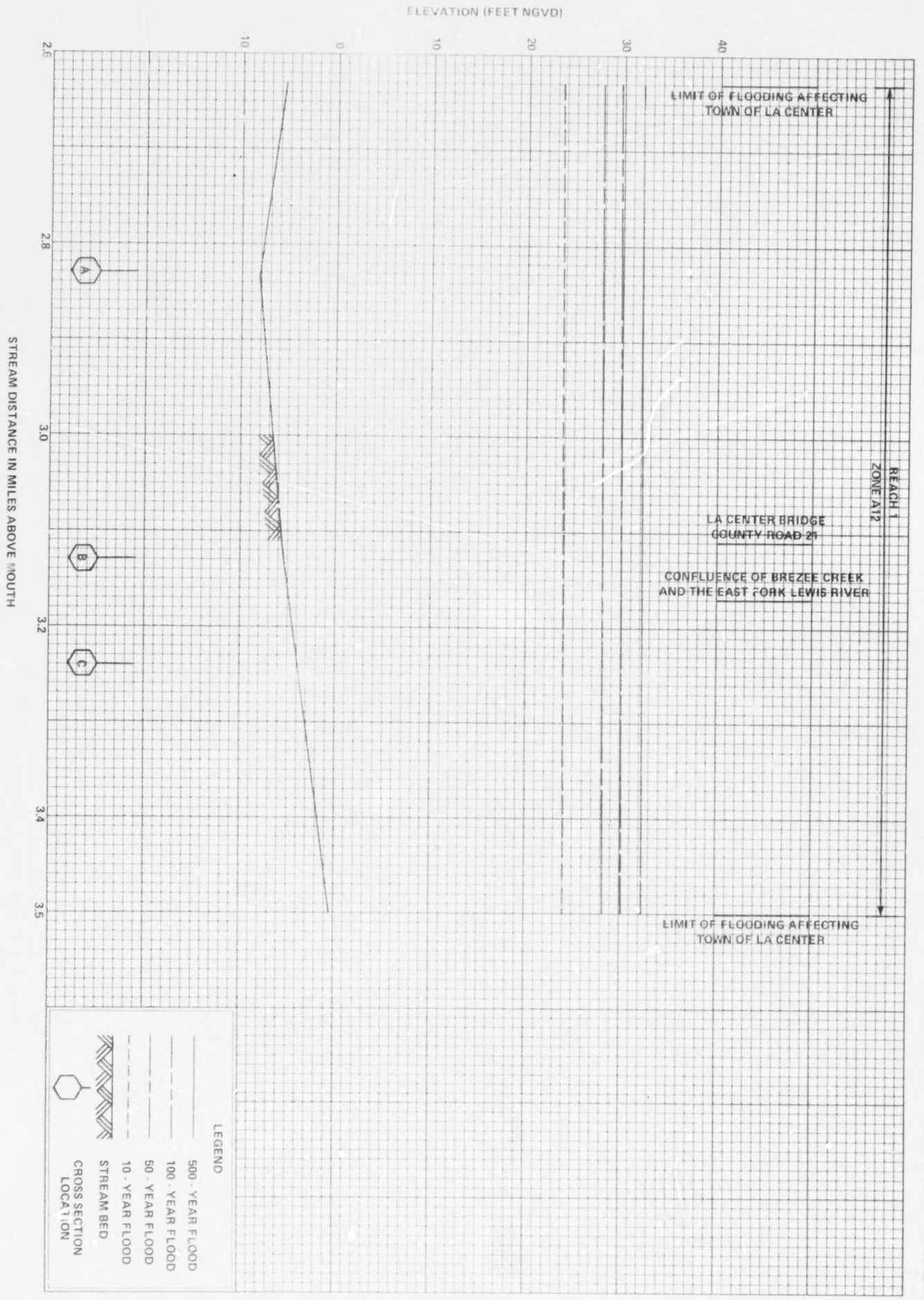
4. U.S. Water Resources Council, "Guidelines for Determining Flood Flow Frequency," Bulletin 17A, June 1977

5. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, November 1976, Updated August 1977

6. U.S. Department of the Army, Corps of Engineers, Portland District, Topographic Survey, Scale 1:4,800, Contour Interval 5 feet: East Fork Lewis River (1973)

7. U.S. Department of the Interior, Geological Survey, Flood-Prone Area Maps, Scale 1:24,000, Ridgefield, Washington, 1973

8. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Town of La Center, Washington, Scale 1:6,000, November 12, 1976



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY TOWN OF LA CENTER, WA (CLARK CO.)	FLOOD PROFILES EAST FORK LEWIS RIVER